Virginia Base Mapping Program
Statewide Road Centerlines and Addressing

The Wireless E-911 Services Board in collaboration with the Virginia Geographic Information Network (VGIN) is working to establish a consistent statewide digital base map for the Commonwealth through the Virginia Base Mapping Program (VBMP). The goal of the VBMP for the E-911 Services Board is to provide digital mapping files to each local government jurisdiction [Public Safety Answering Point (PSAP)] that will meet and sustain the mapping requirements for Wireless E-911 (local and regional) at the lowest possible cost.

The Wireless E-911 Services Board has invested over $9 Million dollars in the VBMP, which has successfully acquired high-resolution digital orthophotography for the entire land base of Virginia, a statewide high-resolution digital hydrography file, and digital terrain models for each of the Commonwealths 134 individual local government jurisdictions.

Digital road centerlines are critical to E-911 operations. The focus of this paper is to identify a cost-effective and timely process for acquiring a statewide digital road centerline file for Virginia that will meet all project goals. This analysis will involve four steps. First, user requirements will be defined. Second, optional resources for centerlines and attribution will be identified and examined. Third, a number of potential digital centerline solutions will be outline and examined. Four, a recommended solution and action steps will be recommended.

1. Road Centerline Acquisition Project Goals and User Requirements

Project Goals: The following four goals are considered critical to building a geospatial road and addressing file, which will support local, state and federal geospatial applications and is efficient to build and maintain over time.

(1) Establish a single and consistent geospatial road centerline file for the VBMP that will meet the needs of both local and state government,
(2) Establish a manageable, cost-effective process for maintaining the file over time,
(3) Minimize or eliminate duplication of centerline mapping, attribution and maintenance across state and local government
(4) Produce an operational file by December 2003.

2. Components of the Virginia Road Centerline file and User Requirements:

Geographic information system (GIS) data or "geospatial" data is characterized by two component parts, which are generally managed in separate but linked databases. The VBMP's requirements for each are identified below:

- **Geography**: The VBMP road centerlines will require geo-referenced vectors (lines) accurately representing the centerline of all streets and roads across the Commonwealth.

  User geography/vector requirements:

  1 Centerlines must conform to the VBMP digital orthophotography*
  2 Centerlines must cover all roads public and private that are critical to E-911
  3 Centerlines must have topology that allows for routing algorithms (includes edge matching)
  4 The ultimate solution must include a manageable cost-effective update process and schedule which does not duplicate existing efforts

  *Conforming to the VBMP digital orthophotography (requirement 1 above) will insure that all additional high-resolution data build from the VBMP digital ortho base (i.e. parcels, utility infrastructure, structures, land cover, etc.) will work with (be integrated) the VBMP road centerline and addressing file.

- **Attribution**: The VBMP will require attributes (i.e. road name, route number, maintenance number, etc.), which clearly identify and distinguish each road segment making it valuable (directly or indirectly) to all potential users.

  User attribution requirements:

  1 Addressing and road naming/numbering must support E-911.
  2 At least a portion of attribution must be consistent across all centerlines statewide
  3 Attribution must support links to state/local government databases
  4 Addressing attribution must support a statewide, database wide search.
  5 Road naming/route numbering should be consistent, if possible, across the entire centerline file (statewide)
  6 Addressing should be standardized, if possible, across the entire centerline file (statewide)
  7 The ultimate solution must include a manageable, cost-effective update process and schedule which does not duplicate existing efforts

3. Options For Developing a Sustainable Road Centerline Geography (Vectors)

In Virginia a number of state agencies and local governments, as well as several commercial companies have created or acquired digital road centerline files and are using them in their operations. These vector files vary in their (1) spatial specifications (accuracy, etc.); (2) extent (area of coverage); and (3) attribution. Each file represents an existing investment that can potentially be leveraged to support the VBMP road

centerline project. Below, existing and potential digital road vector file or sources are identified and evaluated based on the goals and user requirements of Wireless E-911 and the VBMP.

A (1). VBMP Digital Orthophotography (potential centerline file)

Centerlines can be hand digitized from the VBMP orthophotography, which was acquired in February and March of 2002. Numbers in parentheses () refer to the vector requirements listed under **geography** above.

- Advantages: Roads will conform to the VBMP orthophoto base (1)
  All roads can be collected including long driveways (2)
  Road geography will be consistent, statewide (3)
  Road geography will be edge matched statewide (3)
  Road geography will be relatively current (1)

- Disadvantages: Will require an additional investment
  Will require six to 12 months (available Dec 1)
  No procedure for ongoing maintenance is in place (4)
  Files will not include road names or addresses

Digitizing road centerlines from the VBMP digital orthos will ensure that the final road centerline vector file will include all roads and long driveways that are required for E-911. Digitizing road vectors from the VBMP digital orthos also ensures that all additional spatial data that is developed from the VBMP digital orthos (i.e., structures, utilities, etc.) can be accurately used with the road vector file.

Issue 1: Digitizing all roads from the VBMP does not leverage existing road vector files available from VDOT and some local governments.

Issue 2: This solution will also require additional work to attribute the vectors and develop an update plan/process.

- It will be fairly easy to "conflate" either the Census Tiger files or a commercial vector file to the digitized roads in order to add attribution. However both Census Tiger and commercially available files do not have complete, accurate, and current attribution and therefore could not fully support E-911 applications.

- It will be more difficult to "conflate" existing local government road files. This option would provide attribution that should be complete, accurate and current and would provide for an efficient update process through the local government.

B (2). VDOT Digital Road Centerlines

Centerlines of VDOT roads were produced over the last two/three years in the ICAS project. The digital files were created either by driving VDOT maintained roads with a GPS system, acquiring local data, or digitizing from available sources. VDOT maintained roads include public roads statewide, with the exception of [Fairfax County, Henrico County,?] and up to 80 towns. VDOT and its contractors have made an effort to acquire digital centerlines for the counties, cities, and towns where they do not maintain the roads.

- Advantages: Files are available now
  Vectors conform fairly well to VBMP orthos (1)

- Disadvantages: Files do not include all roads (2)
  Vectors do not completely conform to VBMP orthos (1)
  No maintenance/update procedure is in place (4)
  Files do not include road names or addresses
  Files may not be spatially consistent (i.e., accurate) (3)
  Files may not be completely edge matched (3)

While the VDOT road centerline file includes some 65,000 miles of roads the file does not include all roads critical to E-911. (Estimates range up to 125,000 miles of roads)

Issue 1: VDOT centerlines would require additional data collection to provide a road vector file that will work for E-911 and many other applications.

Issue 2: VDOT roads would also require editing to conform to the VBMP digital orthos for integration with additional geospatial data (i.e parcels, structures, utility infrastructure).

Issue 3: VDOT roads will also require attribution for E-911 and development of an update plan/process.

C (3). County and City Developed/Maintained Road Centerlines

A number of counties and cities have developed county/city wide road vectors for their local GIS or computer-aided dispatch (CAD).

- Advantages: Usually these files include attribution (names, adds)
  Usually files are maintained efficiently (4)

- Disadvantages Very limited coverage across the state (2)
  Inconsistent quality statewide (3)
  Will require edge matching at jurisdiction bdry. (3)
  Must be conflated to conform to VBMP orthos (1)

Creating a statewide road file from local government digital road vector files could take advantage of high quality road vector files available from some counties. These files are generally well attributed for E-911 and often have an update plan/process in place for both the road vectors and the attribution.

Issue 1: High quality road centerline vectors are available in only a limited number of counties. Developing a statewide file will require significant additional street centerline data collection.

Issue 2: All files would require editing to conform to the VBMP digital orthophotography.

Issue 3: Even high quality road vectors will vary in quality from jurisdiction to jurisdiction and require edge matching.

D (4). Commercially Available Road Centerlines (GDT, NavTech, TeleAtlas)

Road centerlines that are available commercially from the private sector.

- Advantages
  - Vectors have consistent statewide topology (3)
  - Files are edge matched (3)
  - Centerlines have many names/addresses
  - Available now
- Disadvantages
  - Road coverage is incomplete and limited (2)
  - Attribution is incomplete
  - File maintenance is not rigorous/regular (4)
  - Vectors do not conform to VBMP digital orthos (1)
  - Accuracy is limited and inconsistent

Commercial road centerline vectors extend (to varying extents) across all of the Commonwealth's 134 local government jurisdictions providing a good deal of consistency and eliminating many edge matching requirements. A single commercial file would provide the simplest conflation solution.

Issues 1: The "completeness" of these files is in doubt and probably varies considerably. "Completeness" here refers to the inclusion of all roads, including "long driveways" in the road vector file.

Issue 2: The accuracy of these road vector files is usually closer to 1:24,000 scale than the 1:4,800 and 1:2,400 scales of the VBMP digital orthos. Therefore the commercial files therefore would require significant editing to conform to the VBMP digital orthos.

Issue 3: The attribution of commercial files varies in quality both between and within jurisdictions and there is no established updating procedure.

4. Options for Developing and Maintaining a Statewide Address File (Attribution)

There are a number of options for attributing (i.e., naming, numbering and addressing) digital road centerline vectors. In Virginia a number of state agencies and local governments, as well as several commercial companies have digital road centerline vectors with attribution. 126 counties and cities have completed the E-911 street naming and addressing requirement. However, attribution methods and standards may vary from jurisdiction to jurisdiction. Existing and available road name, road number, and address files are identified below and evaluated based on the goals and user requirements of Wireless E-911 and the VBMP. Numbers in parentheses () refer to the vector requirements listed under **attribution** above.

A. Attribution from Existing Local Government Digital Road Vectors

Individual counties have acquired/developed road files with attribution to support E-911 and /or other geospatial applications.

- Advantages
  - Should meet E-911 attribution standards (1, 2)
  - Cost is limited to conflation (transition to VBMP)
  - Existing update process should be in place (7)
- Disadvantages
  - High administrative overhead to acquire files
  - Higher cost for multiple file conflation

The highest quality attribution is from local government road centerline vectors. Most of these files also include an updating process. However, these files are not available, in a conflatable format, for all counties.

B. New Local Government Attribution (Road names, numbers and addresses) to meet Wireless E-911 mandates (attribution yet to be developed)

Where Individual counties have not acquired/developed road files with attribution to support E-911 and /or other geospatial applications counties must work with the Wireless Services Board and private sector partners to create an accurate road and address file. The attribution process can be completed on the digital road vectors developed for the VBMP.

- Advantages
  - Will meet E-911 attribution standards (1, 2)
  - Will ensure conformance with VBMP
  - Will leverage VBMP investment
- Disadvantages
  - Work must wait for digital road vectors

Producing new attribution [with Wireless E-911 funding] will ensure that standards are met but is an option that is only available for a limited number of counties that have not yet established a E-911 addressing file.

C. Attribution from Commercially Available Digital Road Vectors (GDT, NavTech, TeleAtlas)

Statewide road name, number and address files are available from several private companies for distribution/licensure.

- Advantages — Consistent methods used across jurisdictions (2, 4, 5, 6)
  Only one file to conflate
- Disadvantages — Incomplete/ inconsistent especially in rural areas (1)
  May not conform to addressing standards for E-911 (1)
  Accuracy is questionable (data is second hand) (1)
  No rigorous or regular maintenance plan (7)
  Will require user fees and licenses

Commercially available files should provide consistent attribution across all jurisdictions. However the files accuracy is limited and is incomplete or non-existent in rural areas. In addition there is no formal updating plan/process in place.

Summary of Geography Options – Vector/Line development and maintenance

	User Requirements	VBMP digitizing	VDOT Roads	Local Gov Roads	Commercial Roads
1	Conforms to VBMP orthos	●	Fairly well		
2	Covers all roads for E-911	●		In some counties	
3	Consistent topology for routing	●	Only on VDOT roads		●
4	Ease/cost of attribution			●	Partial attribution
5	Includes efficient update process			●	

None of the listed geography options meet all of the VBMP road centerline user requirements. However, each option, with additional investment and work, could ultimately meet the user needs for the geography component of the VBMP road centerline.

Summary of Attribution Options – Addressing development and maintenance

	User Requirements	A. Existing E-911 Local Gov Attribution	B. New E-911 Local Gov Attribution	C. Commercial Road File Attribution
1	Supports E-911	●	●	
2	Consistent Statewide	**?**	●/*	●
3	Links to State and Local databases	●	●	●
4	Supports a Statewide Search	**	**	●
5	Consistent Numbering and Naming	**1/3**	●	●
6	Standardized Addressing	**1/3**	●	●
7	Includes efficient update process	●	●	

* Only across counties/cities in the "new" category.
**Should not require significant additional cost if options A and B are combined.

None of the listed attribution options meet all of the VBMP road centerline use requirements. However, a combination of options A and B, existing and new local government attribution, should ultimately meet all or the critical majority of VBMP user attribution requirements. While the Commercial Attribution option appears to meet more user requirements it fails to meet the two most critical and potentially expensive requirements, (1) supporting E-911 and (7) including an efficient update process.

5. Identifying Solution Costs and Impacts

Because the VBMP road centerline project is unprecedented on this scale, identifying the cost of some vector and attribution options required information that was not readily available.

Costs related to digitizing and conflation of commercial attribute files were determined through conversations and documentation provided by a number of private sector vendors that specialize in these data and procedures.

Information on the quality, format, and status of existing road centerline and addressing files already developed and being maintained by local governments across Virginia was more difficult to obtain. In an effort to better understand some of the potential cost factors affecting local government vector and attribution options VGIN surveyed each of the 134 jurisdictions in the Commonwealth over the summer and fall of 2002. A summary of the survey results is attached to this document as Appendix A.

6. Digitizing and Commercial/Census File Conflation Costs

Digitizing and commercial file conflation costs are approximate and informal estimates that have been provided by vendors. However, VGIN is confident the estimates were provided in good faith and represent the conservative or higher cost estimate for the defined product or services

- Statewide digitizing of all roads and conflation of commercial or census attribution file (excluding the cost of the attribution file) less than $800,000 (VARGIS, LLC).

- Conflation of a commercial road centerline file with attribution to the VBMP digital orthophotography, approximately $500,000 (Dewberry and Davis, Inc.) This solution does not include all roads and involve licensing restrictions for any use outside of Virginia state and local government (Virginia does not own the data).

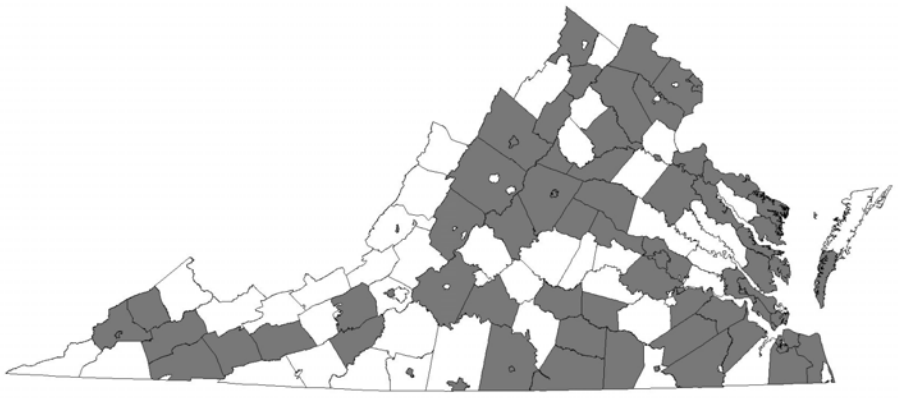
- Conflation of a commercial road centerline file with attribution to the VBMP digital orthophotography: $475,000 one time and $500,000 annually (includes updates). This solution involves licensing restrictions (Virginia does not own the data) but is also based on a detailed data model. The solution cost without licensing restrictions is $2,500,000. (Geographic Data Technologies, Inc.)

7. Local Government Centerline Vector Conflation Option Potentials

The VGIN local government address survey asked several questions that provided insight into the availability and quality of attributed digital road centerline files, which could be conflated to the VBMP. The first critical question is which jurisdictions' road centerlines: (1) were of an accuracy that would easily conflate to the VBMP digital orthos, and (2) included all roads necessary to support E-911.

#1. Street Address Status?

53% - (73/136) Response: 911 Addresses Assigned and **geocoded**.



#4. How is address information stored?

37% - (51/136) Response: **GIS database**
27% - (37/136) Response: **Database or Spreadsheet**
11% - (16/136) Response: **GIS and Database or Spreadsheet**

#5. GIS format of address data?

50% - (68/136) Response: **Shapefile or Coverage** (GIS terms)

#7. Source of Centerline File?

7% - (9/136) Response: **Digital Orthophotography**
55% - (75/136) Response: **Don't Know**

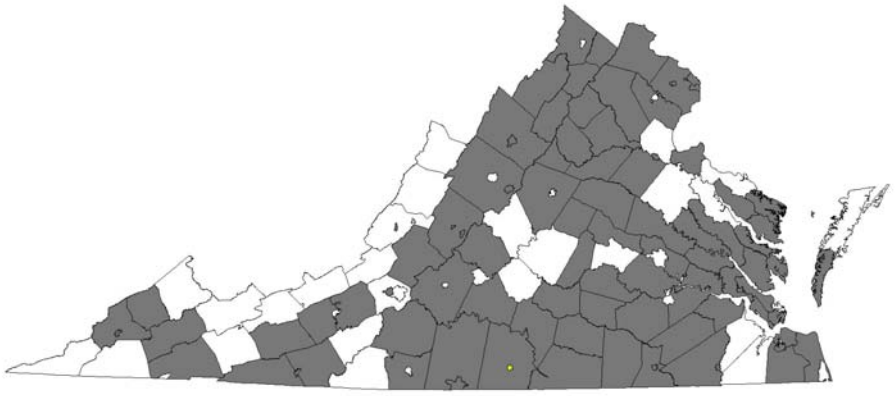
Based on the available survey responses it appears that at 54% of the counties and cities in Virginia have digital road centerline files. Unfortunately, the fact that the responders did not know: (1) the source of the vector data and (2) the survey did not ask for the positional accuracy of the vector files, it is impossible from the available information to determine exactly how many and which counties' digital road vector files could easily be conflated to the VBMP digital orthos. It is assumed that if the digital road vector files are being used to support E-911 (#1 54%: **geocoded**) then they could be conflated to the VBMP digital orthos.

8. Local Government Attribution Conflation Option Potentials

If addresses are attached to digital centerlines then the attribution (i.e. addresses, road names, etc.) will transfer when the digital road vectors are conflated to the VBMP digital orthos. Therefore, a critical question of local governments was the method of addressing they were using. A consistent method of addressing will support cross jurisdictional routing algorithms. A theoretical method of addressing (i.e., linear addressing, grid based addressing) can also simply address updating (though it may have some impact on conflation). Addressing methods are discussed in Appendix B.

#3. Address assignment method?

51% - (70/136) Response: **Linear Based**
10% - (14/136) Response: **Grid Based**
6% - (9/136) Response: **Linear and Grid Based**



A second critical question for the local government addressing option is whether counties are using consistent road naming and addressing standards. Consistent naming and addressing standards will meet a number of critical user needs.

#9. Address Content Standard?

29% - (40/136) Response: **USPS**
38% - (53/136) Response: **Other**
30% - (42/136) Response: **No Response**

The potential role for the local government in the updating process and the a measure of the potential impact of alternative solutions on local governments can be assessed from the survey question on in-house addressing.

#2. Addressing done in house?

86% - (117/136) Response: **YES**
6% - (9/136) Response: **No**
7% - (10/136) Response: **No Response**

These survey responses justify several assumptions relating to value of local government addressing files as a potential attribution solution:

1. Local government address attribution should be available and transfer at no cost if local government digital centerlines are conflated to the VBMP.

2. Local government attribution will provide an adequate level of consistency across files.

3. With 82% of local governments updating their files using local government attribution in the VBMP road centerline solution should have a very low impact on local governments and not require an additional investment in establishing a new update procedure.

9. Potential Road Centerline Geography (Vector) Solutions and Estimated Costs

#1.	Digitize all roads from the VBMP	$800,000*
#2.	Conflate VDOT centerlines to VBMP Digitize all remaining roads and long driveways	$750,000*
#3.	Conflate Local Government Digital Centerlines to the VBMP Conflate VDOT roads in areas where valuable Digitize all remaining roads and long driveways Add New local government attribution (9 counties)	$750,000*

* Includes conflation of commercial or census files or local government files for partial attribution. If commercial files are used licensing restrictions apply

10. Potential Road Centerline Attribution Solutions and Estimated Costs

#A. Conflate commercial or census files to vectors statewide**
Establish local government program to update and complete attribution

$??????***

** Includes license restrictions if commercial files are used
*** Local government program will impact all 134 jurisdictions

#B. Conflate local government files to vectors for existing jurisdictions with geocoded attribution
Conflate census files to all other jurisdiction's vectors
Establish local government program to update and complete attribution where necessary

$??????***

*** Local government program will impact between 25% and 50% of Virginia's 134 jurisdictions (33 to 67)

11. Identifying the Best Road Centerline Solution

Identifying the best solution for building and maintaining a VBMP Road Centerline File for E-911 and multiple local, state, and federal geospatial applications has three critical requirements.

1. The final solution should reflect the most efficient (lowest cost) combination of vector and attribution options that meets all user needs requirements. Therefore the best solution might not be a combination of the least expensive vector solution and the least expensive attribution solution because the two may not work together.

2. The solution must not have a significant impact on existing local government E-911 efforts. The final solution must provide local governments with an attributed road centerline and a maintenance process that provides enough advantages to outweigh any potential costs for the local jurisdiction. If this is not the case it will be difficult to get local government cooperation, which is critical to the long-term success of the VBMP.

3. The final solution must be sustainable over time.

12. The Complete Solution Options

Vector Option #1 works with Attribution Option A or B.

Vector Option #2 works only with Attribution Option A.

Vector Option #3 works with Attribution Option B.

13. The Recommended Solution

The recommended solution is using Vector Option #3 with Attribution Option B.

3. Conflate Local Government Digital Centerlines to the VBMP
   Conflate VDOT roads in areas where valuable
   Digitize all remaining roads and long driveways
   Add New local government attribution (9 counties)

A. Conflate local government files to vectors for existing jurisdictions with geocoded attribution
   Conflate census files to all other jurisdictions' vectors

Establish local government program to update and complete attribution where necessary

This is considered the best solution because it (1) will meet all user requirements, (2) is potentially the low cost solution, and (3) has the lowest impact on local government operations and most effectively leverages existing local government operations.

This solution is based on the assumption that it will be less expensive to "edit" road centerline vector files that already exist rather than digitize new ones from scratch. In this case "editing" refers to overlaying existing centerline vectors on the VBMP digital orthophotography and adjusting/editing the vectors to accurately "fit" the digital orthophotography base.

VGIN has made one test of this possible option. VGIN overlaid approximately 23 miles of VDOT centerline vectors from the Farmville area onto VBMP digital orthophotography at 1:2400 scale. VGIN then identified 14 cosmetic errors where VDOT centerline vectors did not lie in the "center" of the road. VGIN also identified 11 errors where VDOT centerline vectors extended "off" the road. The total number of both error types came to approximately one error per road mile.

Besides the available VDOT centerline vectors there are a number of counties and cities in the Commonwealth (estimated at 68) that have developed good quality road centerline vectors that should "fit" well with the VBMP digital orthophotography, allowing for some "editing". <u>These local government vector files have the significant additional advantage of having (in most cases, if not all) attribution including road names, numbers, and addresses, which will meet E-911 and VBMP attribution requirements.</u>

Local government road centerline vector files that can be used to augment and support the digitizing process will generally also have an updating procedure in place for both the vector files and the attribution. <u>Using existing attribution and updating processes is very important as it takes full advantage of existing investments and minimizes impacts on existing local government operations</u>.

14. Estimating Total Project Cost

Estimating the total cost for implementing a fully attributed and functional VBMP road centerline file is dependent on sub-total estimates for: (1) the cost of producing the geocoded road centerline file, and (2) the cost of attributing (updating census based attribution) for local governments with E-911 compliant addressing, but no geocoded street centerlines.

(1) Geocoded road centerline file costs include:

a)	conflation of existing local government centerlines and digitizing	$ 700,000

b)	attribution of centerlines to meet VBMP road centerline data model requirements	Not Available
c)	project management overhead	$ 60,000

(2) Attribution update and correction costs depend upon:

c)	the number of counties that require updates: 67 *	
d)	the cost of updates per county/city: $12,000 **	$ 800,000
e)	project management overhead	$ 60,000

Estimate of **TOTAL COST $ 1,620,000****

* conservative estimate based on available data from Address Survey
** estimate based on following assumptions: 50,000 miles @ approximately $16/mile

15. Potential Implementation Steps Road Centerline Vector Solution

1. Work with VDOT and E-911 specialists to identify a "VBMP road centerline data model" for roads that will meet their needs.

2. Resurvey Virginia's 134 jurisdictions for detailed and targeted information to: (a) verify and potentially sample "geocoded" E-911 databases, and (b) identify and sample E-911 compliant databases that are not geocoded.

3. Evaluate local government geocoded road files for compliance with the VBMP road centerline data model.

4. Work to establish a statewide addressing standard.

5. Conflate geocoded local government road centerlines with the VBMP digital orthophotography. Each vector will be checked for "errors" and edited if necessary to ensure that road centerline vectors "fit" the VBMP digital orthophotography. Each orthophoto is also reviewed to ensure that the road centerline vector files are complete (i.e. include all roads and long driveways). Missing roads will be digitized.

6. For jurisdictions where local government road centerline vectors are not available, VDOT road centerline vectors will be conflated to the VBMP digital orthos. Vectors with "errors" will be corrected/adjusted. Each orthophoto will be reviewed and missing road centerline vectors will be digitized to ensure that the road centerline vectors are complete. Digitizing/editing will include edge matching with adjoining vector files.

7. Where local government centerline vectors become the VBMP road centerline vector file the attribution including road names, numbers and addresses should already be complete and current. Establishing an updating plan and schedule will require an agreement with each local government.

8. Where VDOT centerline vectors become the VBMP road centerline vector file, (augmented by digitizing from the VBMP digital orthos) attribution (i.e., road names and addresses) will come from one of two solutions.

    - Local governments that have not yet developed E-911 address files will use VBMP road centerline files to complete that process (supported by the E-911 Wireless Services Board).

    - A program for updates and/or correcting the VBMP road centerline Census attribution will be established for local governments with an existing road name and address file, which meets E-911 standards, but is not geocoded (therefore the attribution cannot be conflated to the VBMP road centerlines).

Appendix A. (VBMP Road Centerline Project)

Address Survey Summary

Street Address Status?

Answers possible: Survey Code Number of Responses

No Response	0	3	2.21%
Rural Route Box Numbers	1	6	4.41%
Are in the Process of being assign	2	8	5.88%
Assigned, used for 911	3	10	7.35%
Assigned, used for 911, digitally	4	29	21.32%
Assigned, used for 911, geocoded	5	73	53.68%
Other	6	4	2.94%
2 & 3	7	1	0.74%
4 & 5	8	2	1.47%
		136	

Addressing Done In house?

Answers possible: Survey Code Number of Responses

No response	0	10	7.35%
Yes	1	117	86.03%
No	2	9	6.62%
		136	

Address Assignment Method?

Answers possible: Survey Code Number of Responses

No Response	0	17	12.50%
Grid based	1	14	10.29%
Linear based	2	70	51.47%
Geographic based	3	3	2.21%
other	4	18	13.24%
1 & 2	6	9	6.62%
1 & 4	7	1	0.74%
2 & 3	8	2	1.47%
3 & 4	9	2	1.47%
		136	

How is you address information stored?

Answers possible:	Survey Code	Number of Responses	
No Response	0	21	15.44%
Hard copy only	1	8	5.88%
Database/spreadsheet	2	37	27.21%
GIS	3	51	37.50%
1,2 & 3	4	1	0.74%
2 & 3	5	16	11.76%
1 & 2	6	2	1.47%
		136	

GIS Format of Address Data?

Answers possible:	Survey Code	Number of Responses	
No Response	0	58	42.65%
ESRI Shapefile	1	35	25.74%
ESRI Coverage	2	24	17.65%
Other	3	10	7.35%
1 & 2	4	4	2.94%
1 & 3	5	3	2.21%
2 & 3	6	2	1.47%
		136	

GIS Feature Type of Address Data?

Answers possible:	Survey Code	Number of Responses	
No Response	0	63	46.32%
Point	1	24	17.65%
Line	2	38	27.94%
Polygon	3	2	1.47%
1, 2 & 3	4	1	0.74%
1 & 2	5	5	3.68%
2 & 3	6	2	1.47%
Dynamic Segmentation	7	1	0.74%
		136	

Source of Centerline file?

Answers possible:	Survey Code	Number of Responses	
No Response	0	30	22.06%
Hi-Res DO?	1	1	0.74%
DOQQ	2	8	5.88%
Census Tiger	3	21	15.44%
Other	4	1	0.74%
Don't Know	5	75	55.15%
		136	

Address update schedule?

Answers possible:	Survey Code	Number of Responses	
No Response	0	31	22.79%
Daily	1	32	23.53%
Weekly	2	8	5.88%
Monthly	3	4	2.94%
Quarterly	4	3	2.21%
Annually	5	1	0.74%
As needed	6	53	38.97%
other	7	4	2.94%
		136	

Address Content Standard?

Answers possible:	Survey Code	Number of Responses	
No Response	0	42	30.88%
USPS	1	40	29.41%
FDGC	2	1	0.74%
Other	4	53	38.97%
		136	

Appendix B. (VBMP Road Centerline Project)

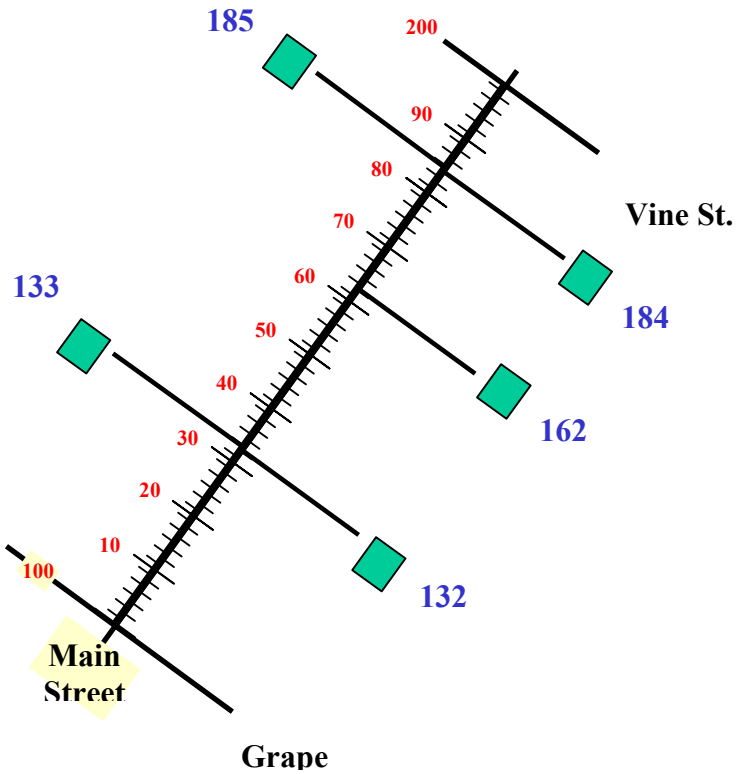
Addressing Methods - Linear

Typically a jurisdiction designates an addressing scheme based on population and the volume of housing units. Linear-based addressing establishes house numbers based on the number of increments from the beginning of a road. An increment can be any number of feet or division of a mile. A standard increment for urban settings is a 5.28 foot increment and 52.8 feet for rural areas. The side-of-road is relative to a vehicle proceeding along the road in the direction of ascending numbers (from the beginning of the road). Typically, odd numbers are assigned to the buildings on the left and even numbers to buildings on the right. An example of this scheme is a building ½ mile from the start of the road on the right side would get an address of 50 using the 52.8 foot increment with even parity on the right side of the road. The left side address would be 49 or 51.

A 5.28-foot (.001-miles) increment provides a sufficient quantity of numbers even in densely populated areas (10.6 feet on each side of road), while rarely exceeding 4-digits except on roads that are longer than 10-miles. The number is easily locatable from an odometer (e.g. an address of 1678 = 1.678 miles from start of road). In rural areas, the 52.8 feet increment is easily locatable from an odometer (.01 miles) as well. Unfortunately, this increment requires buildings be approximately 100 feet apart on each side of the road and cannot be used in many urban areas. All other increments have no direct, easily converted relationship to an odometer mileage.

This method allows a locality to establish a theoretical address range with which addresses can be logically assigned.

Example of linear based addressing:

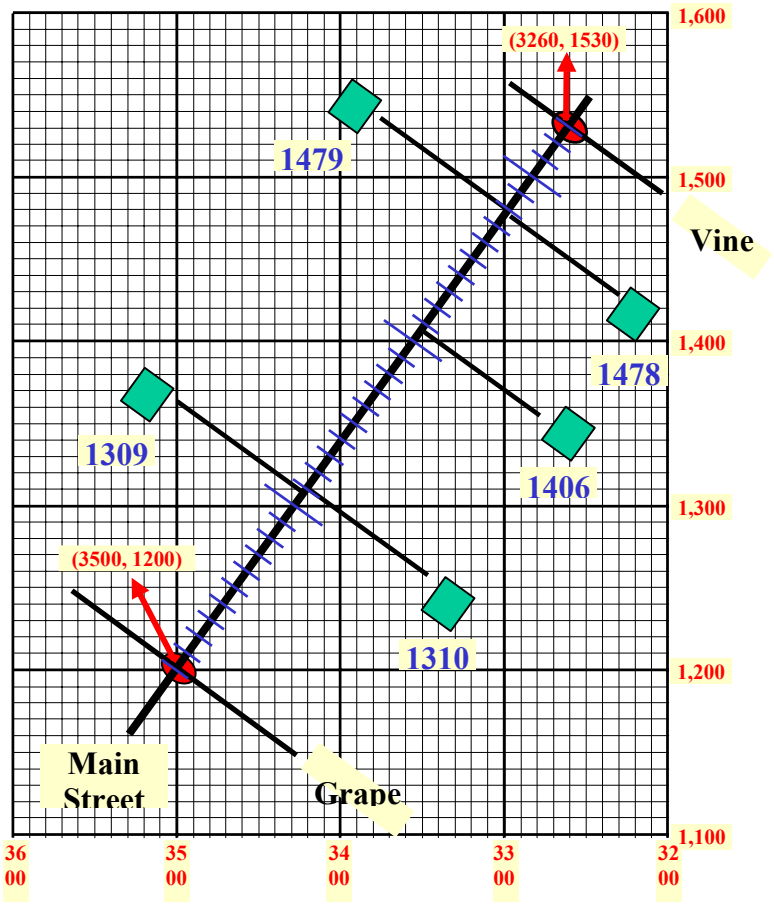


Addressing Methods - Grid

Grid addressing establishes a northing and easting coordinate system for your locality. Addresses are then developed from the east-west coordinate (x) plus the north-south coordinate (y). Numbers tend to be very large as each coordinate value is generally 3-digits. If the locality covers a large area, other numbers may need to be added to indicate the sector of the grid. In addition, any road that curves back in an east-west direction can have addressing that is out of order.

Similar to the linear method of address assignment, the grid-based method allows the locality to establish a theoretical address range with which addresses can be logically assigned.

Example of grid-based addressing:



Addressing Methods - Geographic

Geographic addressing uses X and Y geographic coordinate values (latitude/longitude, state plane, etc.) in determining addresses. For example a structure located at the coordinates 1,300,000 / 9,000,000 might be assigned an address of 1390 if the locality uses the first two digits of both the X and Y coordinate values or 9013 if the locality uses the first two digits of the coordinates but chooses to list the Y digits first.

Example of geographic-based addressing: